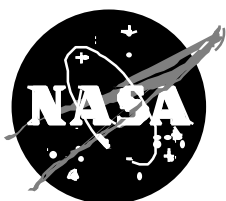


MISSION OPERATIONS AND DATA SYSTEMS DIRECTORATE

**Earth Observing System (EOS)
Data and Information System
(EOSDIS)
Backbone Network (EBnet)
System/Acceptance Test Plan and
Procedures**

July 1996



National Aeronautics and
Space Administration

Goddard Space Flight Center
Greenbelt, Maryland

**Earth Observing System (EOS)
Data and Information System (EOSDIS)
Backbone Network (EBnet)
System/Acceptance Test Plan and Procedures**

July 1996

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Preface

This document is under configuration management of the National Aeronautics and Space Administration (NASA) Communications (Nascom) Division Configuration Control Board (CCB).

Proposed changes to this document shall be submitted to the Nascom CCB along with supportive material justifying the change. Changes to this document shall be made by Document Change Notice (DCN) or by complete revision.

Questions concerning this document and proposed changes shall be addressed to:

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Abstract

The Earth Observing System (EOS) and Data Information System (EOSDIS) Backbone Network (EBnet) project is an initiative to provide the operational communications network necessary to support EOS. The System/Acceptance Test Plan and Procedures provides a structural framework for conducting design validation, requirements verification, and operational acceptance of EBnet. The scope of this document includes the test methodology and detailed procedures.

This document is being delivered in two phases. The System/Acceptance Test Plan will be developed first and presented at the EBnet Critical Design Review. The detailed test procedures will be developed in the second phase. They will be available to support the initial Factory Acceptance Test (FAT) effort. In this submission, the test procedure template has been provided to provide insight into the information that will be contained in each test procedure.

Section 1 of the System Test Plan and Procedures provides an introduction to the document. Section 2 provides applicable documents. An overview and test approach are discussed in Sections 3 and 4, respectively. The test procedure template, requirements verification matrix, glossary, and list of acronyms are provided in appendices.

Keywords: *EBnet, EOSDIS Backbone Network; ESDIS, Earth Science Data and Information System; EOSDIS, Earth Observing System and Data Information System; Level II; MO&DSD, Mission Operations and Data Systems Directorate; ECS, EOSDIS Core System; EDOS, EOS Data and Operations System; TRMM, Tropical Rainfall Measurement Mission; Landsat-7; requirements verification; design validation; acceptance testing*

Change Information Page

List of Effective Pages			
Page Number		Issue	
Title/Signature		Original	
iv through ix		Original	
1-1 and 1-2		Original	
2-1 through 2-1		Original	
3-1 through 3-8		Original	
4-1 through 4-10		Original	
AB-1 through AB-4		Original	
GL-1		Original	
A-1 through A-4		Original	
B-1 through B-11		Original	
DL-1 through DL-1		Original	
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DCN Number	Date/Time Group (Teletype Only)	Month/ Year	Section(s) Affected	Initials

Contents

PREFACE	iv
ABSTRACT	v
CHANGE INFORMATION PAGE	vi
DCN CONTROL SHEET	vii
SECTION 1. INTRODUCTION	1-1
1.1 AUTHORITY	1-1
1.2 PURPOSE	1-1
1.3 SCOPE	1-1
1.4 DOCUMENT ORGANIZATION	1-1
1.5 INFORMATION FORMAT	1-2
1.6 PLAN MAINTENANCE.....	1-2
SECTION 2. APPLICABLE DOCUMENTS	2-1
2.1 SOURCE DOCUMENTS	2-1
2.2 REFERENCE DOCUMENTS	2-1
SECTION 3. OVERVIEW	3-1
3.1 SYSTEM OVERVIEW.....	3-1
3.2 MAJOR SYSTEM FUNCTIONS	3-1
3.3 EBNET IMPLEMENTATION OVERVIEW	3-4
3.4 TEST PROGRAM OVERVIEW	3-5
3.5 TEST TEAM ROLES AND RESPONSIBILITIES	3-7
SECTION 4. TEST PLAN.....	4-1
4.1 TEST OBJECTIVES.....	4-1
4.2 FAT	4-1
4.2.1 Assumptions and Constraints	4-1
4.2.2 Transport Function.....	4-1
4.2.3 NOC Function.....	4-3
4.2.4 Network Management Agent Function	4-3
4.3 SI&AT	4-4
4.3.1 Assumptions and Constraints	4-4
4.3.2 Transport Regression Testing	4-4
4.3.3 Network Management Regression Testing	4-5
4.4 LEVEL 2 REQUIREMENTS VERIFICATION	4-5
4.4.1 Assumptions and Constraints	4-5
4.4.2 Technical Analysis	4-6
4.4.3 Inspection.....	4-6
4.4.4 Test.....	4-6
4.5 TEST SUPPORT ENVIRONMENT	4-7

4.5.1	FAT	4-7
4.5.2	SI&AT	4-7
4.5.3	Level 2 Requirements Verification	4-7
4.6	SCHEDULE REQUIREMENTS	4-7
4.7	SECURITY CONSIDERATIONS	4-7
4.8	PROBLEM REPORTING AND DISCREPANCY HANDLING	4-9
4.8.1	Problem Reporting.....	4-9
4.8.2	Discrepancy-Handling Procedures.....	4-9
4.9	ACCESS TO TEST RESULTS	4-10
4.9.1	On Site	4-10
4.9.2	Off Site.....	4-10
ABBREVIATIONS AND ACRONYMS		AB-1
GLOSSARY		GL-1
APPENDIX A FAT PROCEDURE TEMPLATE		A-1
APPENDIX B REQUIREMENT VERIFICATION MATRIX.....		B-1
DISTRIBUTION LIST		DL-1

Section 1. Introduction

1.1 Authority

The Mission Operations and Data Systems Directorate (MO&DSD) has the authority to implement EBnet. This authority was granted to the MO&DSD by the Earth Science and Data Information System (ESDIS) project. The EBnet project is under the Nascom division of MO&DSD. Accordingly, this document is approved by the EBnet Project Manager (PM) and controlled by the Nascom CCB.

1.2 Purpose

This document describes the test plan and procedures for performing design validation, requirements verification, and acceptance of EBnet.

The purpose of the System/Acceptance Test is to complete component and system certification testing in order to validate design, verify EBnet Level 2 requirements, and perform acceptance testing. The following goals were considered in the generation of the approaches used in this plan:

- Ensure that EBnet functionality required to support formal mission operations testing (e.g., Tropical Rainfall Measurement Mission [TRMM] Operations, AM-1 Operations) is certified before use by sister EOSDIS projects, EOSDIS System Integration and Test (SI&T) and end-user project testing (e.g., TRMM and Landsat-7). The first formal mission operations test efforts are associated with TRMM Operations (EOSDIS Core System [ECS] Release A).
- Develop a test approach that ensures specific requirements verification and design validation are performed only once with further testing accomplished through an appropriate level of regression test.
- Make best use of existing resources, tools, and plans to ensure efficient completion of test planning and execution.
- Evaluate current test plans of EBnet users (e.g., TRMM, Landsat-7) and other EOSDIS sister projects to determine applicability to requirements verification.
- Generate test methodology that supports future EBnet network testing activities.

1.3 Scope

This plan provides a detailed summary of EBnet requirements verification, operational acceptance, and regression tests activities. It outlines required resources, scheduling, and coordination procedures as well as test results reporting. Test descriptions, configurations, and detailed procedures are also included.

1.4 Document Organization

This plan provides the framework for performing formal testing associated with EBnet design validation, requirements verification, and acceptance. This document is organized as follows:

- Section 2 lists applicable documents
- Section 3 describes the capabilities to be tested and provides an overview of the system test program
- Section 4 describes the system test approach, resource and schedule requirements, and problem and test results reporting procedures
- In the appendices, the following are provided: (1) test procedure template (to be replaced with the detailed test procedures in the second submission); (2) requirements verification matrix; (3) list of abbreviations and acronyms; and (4) a glossary.

1.5 Information Format

Section 2 lists applicable documents. The document numbers are indicated within brackets, [] where they are referenced (after Section 2).

The first occurrence (subsequent to Sections 1 and 2) of each glossary entry is underlined.

1.6 Plan Maintenance

The System/Acceptance Test Plan and Procedures will be analyzed as Project changes (e.g., EBnet Level 2 requirement changes) occur.

Section 2. Applicable Documents

The following documents are incorporated by reference into this document to the extent they are applicable to completing the System/Acceptance Test.

2.1 Source Documents

- [1] *Earth Science Data and Information System (ESDIS) Project Level 2 Requirements, Volume 6 EOSDIS Backbone Network (EBnet) Requirements*, 505-10-01-6, December 1995
- [2] *EOSDIS Backbone Network (EBnet) Interface Requirements Document*, 540-022, April 1996
- [3] *EOSDIS Backbone Network (EBnet) Design Package*, May 1996

2.2 Reference Documents

- [4] *EBnet Traffic Database*, Baseline, April 1996
- [5] *EOSDIS Backbone Network (EBnet) System Implementation Plan (SIP)*, 540-016, April 1996

Section 3. Overview

3.1 System Overview

The EBnet provides wide-area communications circuits and facilities between and among various EOS Ground System (EGS) elements to support mission operations and to transport mission data between EOSDIS elements. The relationship of EBnet to other elements supporting EOS is shown in Figure 3-1. EBnet is responsible for transporting spacecraft command, control, and science data nationwide on a continuous basis, 24 hours a day, 7 days a week. Real-time data includes mission-critical data related to the health and safety of on-orbit space systems and raw science telemetry as well as prelaunch testing and launch support. Science information includes data collected from spacecraft instruments and various levels of processed science data including expedited data sets, production data sets, and rate-buffered science data.

In addition to providing the wide-area communications through common-carrier circuits for internal EOSDIS communications, EBnet serves as the interface to other systems such as Distributed Active Archive Centers (DAACs), users, and the NASA Science Internet (NSI). EBnet also includes a campus interface which provides communications between the Wide Area Network (WAN) and Local Area Networks (LAN). Figure 3-2 depicts EBnet and its interfaces.

Key functional objectives of EBnet are:

- Transport - EBnet must provide means to transport spacecraft forward and return data between the ECS and EOS Data and Operations System (EDOS) and to transport science data between DAACs
- Network Management - EBnet must enable and assure on a system-wide basis the management of system resources and system operations.

The *EBnet Traffic Database* [4] contains the functional data flows associated with each interface including physical source and receiver of the data, numeric data-flow designation, instrument supported, data type supported, and communications link (e.g., real-time, science) type supporting each interface.

The *Earth Science Data and Information System (ESDIS) Project Level 2 Requirements, Volume 6 EOSDIS Backbone Network (EBnet) Requirements*, [1] contains the pertinent performance and availability requirements.

3.2 Major System Functions

EBnet will be implemented through use of Commercial Off-The-Shelf (COTS) equipment. The two major EBnet functions are transport and network management. The transport function is implemented through the use of an Internet Protocol (IP) router-based network providing the

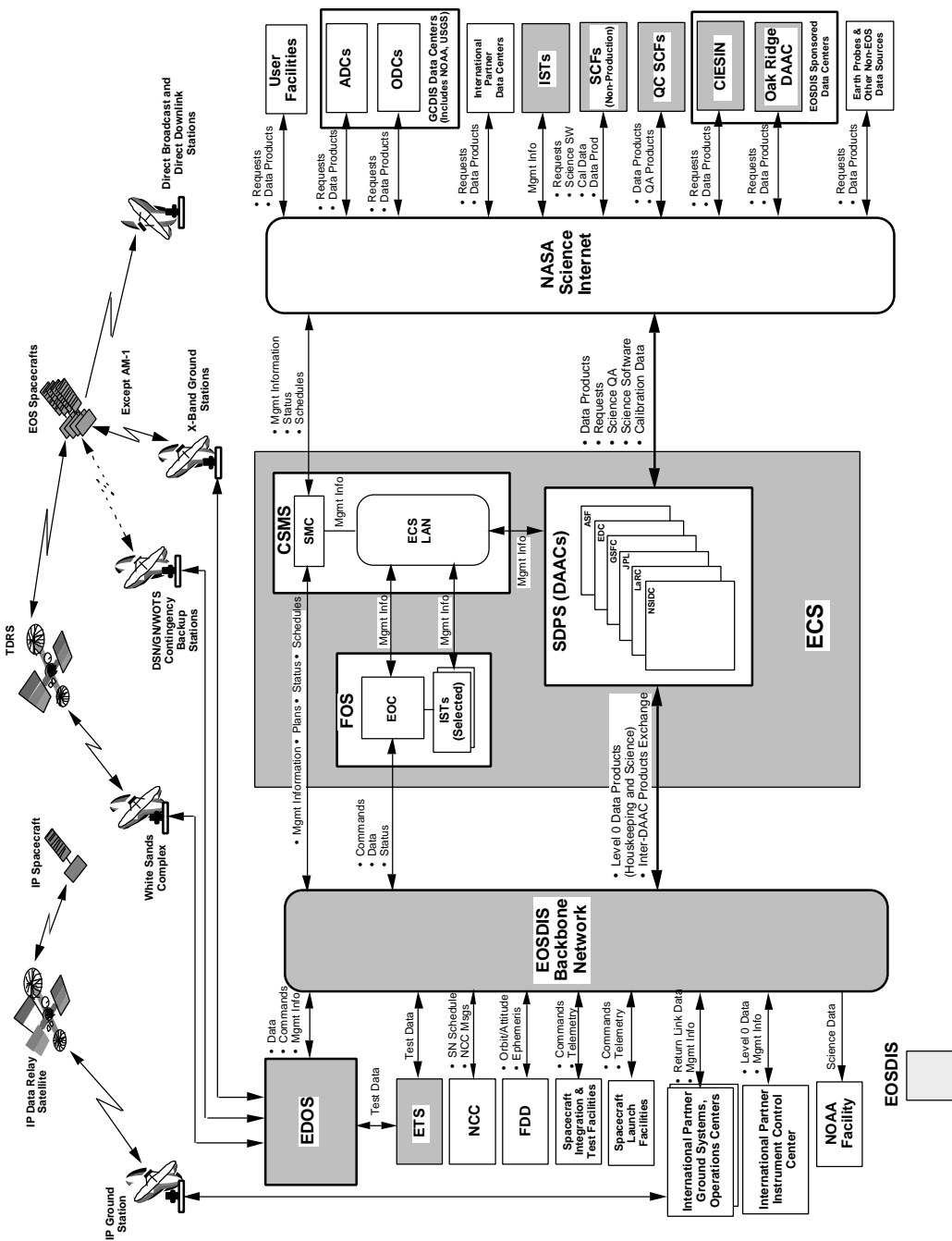


Figure 3-1. EOS Ground System

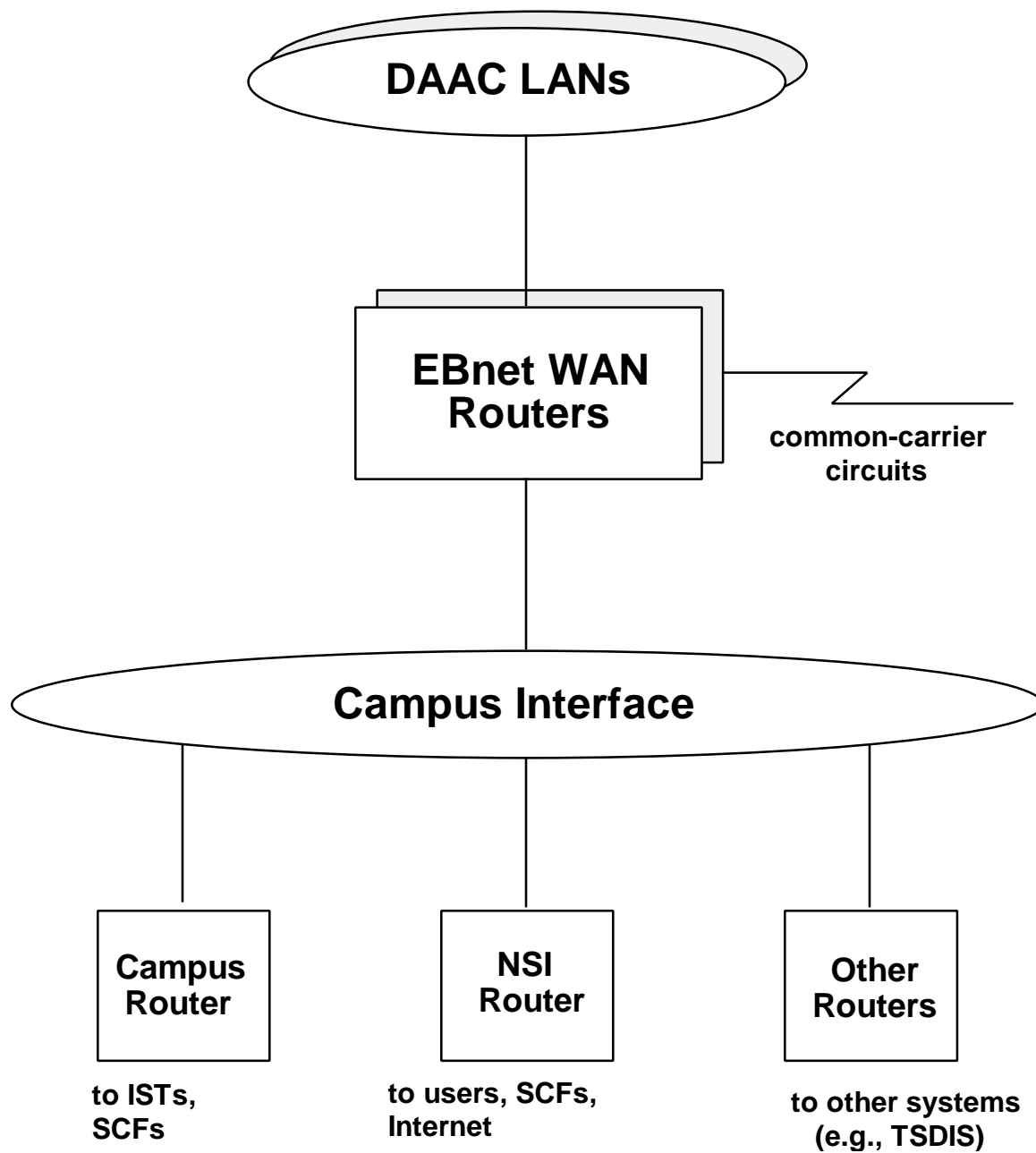


Figure 3-2. EOSDIS Backbone Network

capabilities for EBnet to transfer data and management information. The Simple Network Management Protocol (SNMP) based network management function is implemented in two entities: the centralized network management function that resides in the Network Operations Center (NOC) at GSFC and the network management function embedded within each device at each node (also known as the network management agent).

The respective test cases to be performed during design validation, requirements verification, and acceptance test are derived from the major functions listed above.

3.3 EBnet Implementation Overview

EBnet implementation approach uses a “just-in-time” concept. Equipment and communications circuits will be installed to support: (1) TRMM Operations/AM-1 Early Tests (Release A) in 1996; and (2) AM-1 Operations (Release B) in 1997. The EBnet equipment implementation will involve a two-step process of integrating and testing the equipment in a “factory” environment followed by installation and testing at the EBnet nodal site. Detailed information related to the EBnet implementation is contained in the *EOSDIS Backbone Network (EBnet) System Implementation Plan (SIP)* [5].

Installation and test of EBnet equipment to support TRMM Operations/AM-1 Test will be completed in mid 1996. Equipment will be installed at GSFC, Langley Research Center (LaRC), and Valley Forge Pennsylvania (VFPA). EBnet will be in the position to support:

- GSFC and LaRC DAACs
- System Management Center (SMC)
- EOS Operations Center (EOC)
- Flight Dynamics Facility (FDF)
- EOSDIS Test System (ETS)
- Spacecraft Checkout System (SCS)
- Spacecraft Simulator (SSIM)
- TRMM Science Data and Information System (TSDIS).

In early 1997, equipment will be installed to support AM-1 Operations. The second equipment release will include additional nodes. The network will now include all EBnet elements to support the EOS AM-1 launch. The sites planned for this installation include:

- Earth Resources Observation System (EROS) Data Center (EDC)
- Jet Propulsion Laboratories (JPL)
- Data Interface Facility at the White Sands Complex (WSC)
- Alaska Synthetic Radar Aperture (SAR) Facility (ASF)

- National Snow and Ice Data Center (NSIDC)
- National Oceanic and Atmospheric Administration (NOAA)
- Spacecraft Analysis System (SAS) and Software Development System (SDS) at Valley Forge
- Three new points of presence will be included at GSFC to support Advanced Spaceborne Thermal Emission Radiometer (ASTER), the Landsat Processing System (LPS), and the Flight Software Testbed (FSTB)
- Launch Processing Facility (LPF) at Vandenberg Air Force Base (VAFB)
- Norway and Alaska Earth Stations.

3.4 Test Program Overview

The EBnet project will conduct two series of tests. These tests are the FAT and System Integration and Acceptance Test (SI&AT). These tests will be performed for each major release of EBnet equipment as shown in Figure 3-3. The flow of testing shown in Figure 3-3 mirrors the “just-in-time” implementation approach with testing scheduled to support first the TRMM Operations/AM-1 Early Tests (Release A) and then the AM-1 Operations (Release B).

The FAT will serve as the Developer Component Acceptance Test. The FAT will address support contractor integration and test activities to ensure the equipment is ready for shipment to a site. The equipment will be configured to meet specific site requirements. A series of in-house tests will be performed to ensure proper equipment functionality and component operation to permit installation of equipment after shipment to the site. The EBnet Integration Team, led by the Nascom System Engineering Branch and supported by the Consolidated Network and Mission Operations Support (CNMOS) (Computer Sciences Corporation [CSC]/Loral Aerosys) and Hughes STX, will complete the integration and test using structured test procedures. Test procedures will include test cases to: (1) verify component operations of EBnet equipment; (2) check EBnet-specific parameters of the configured node; and (3) test the final node in a simulated network. Specific test cases required to complete this testing are expected to mirror standard transport and network management test cases to check out router-based equipment. Discrepancies will be tracked in a database. Serious issues that will impact the ability of the EBnet Installation Team to successfully complete their effort will be corrected before shipping. All other issues will be reviewed and impacts evaluated. Necessary work-off plans, including required on-site activities, will be identified.

The SI&AT will provide the means for performing independent site certification of EBnet components and will provide a logical hand-off of nodal Maintenance and Operations (M&O) responsibilities to operations. This testing will be performed by the EBnet Implementation Team led by the Nascom System Engineering Branch and supported by CNMOS (CSC/Loral Aerosys, AlliedSignal Technical Services Corporation [ATSC]), and Hughes STX using a series of regression tests from FAT. These regression tests will focus on ensuring: (1) the equipment still functions properly after shipment and installation; (2) user, operator, and network management interfaces are configured correctly; and (3) logistics support is available at the node.

Discrepancies will be tracked in a database with resolution of discrepancies addressed by the designated party

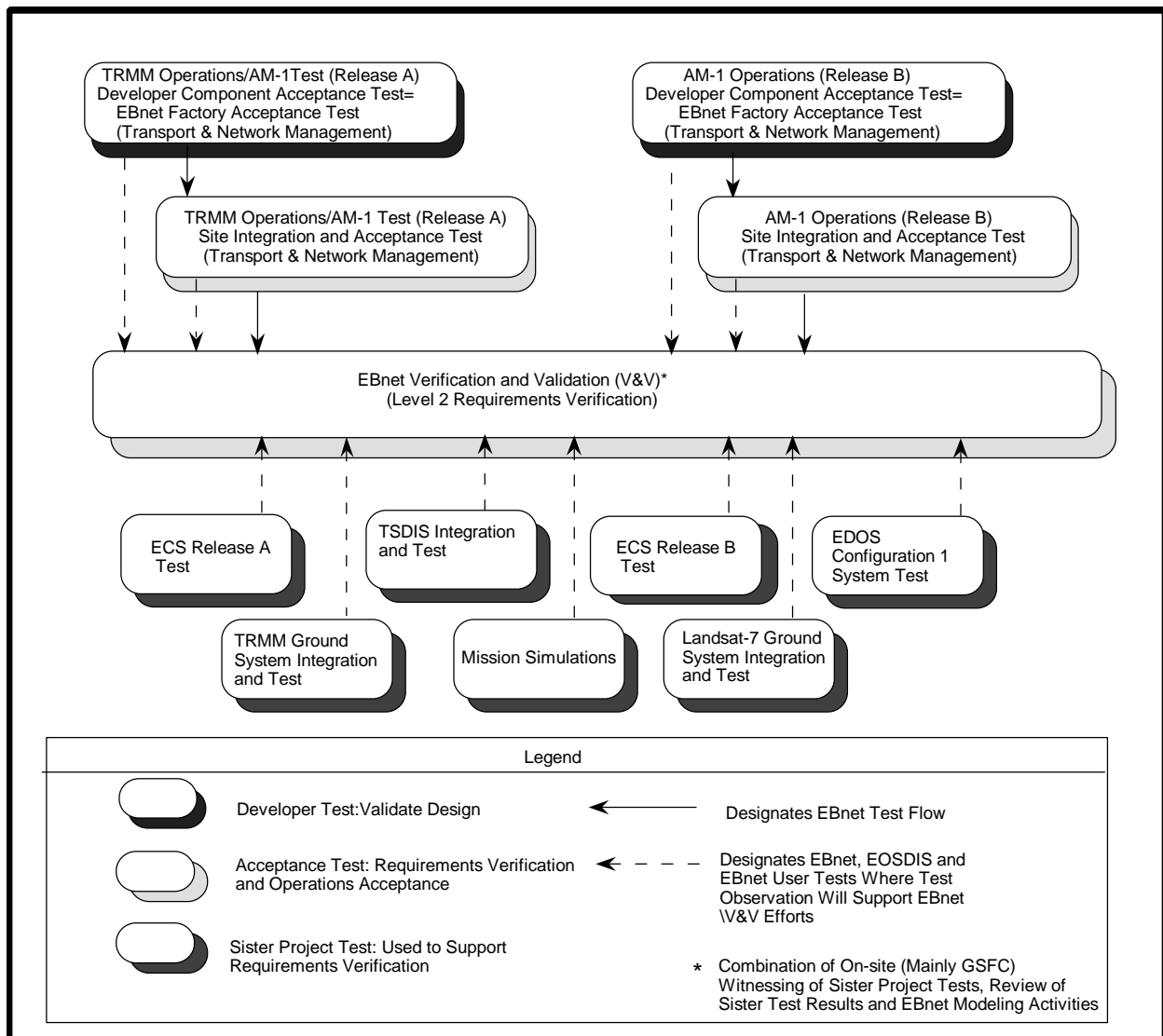


Figure 3-3. EBnet System/Acceptance Testing Overview

(e.g., EBnet Design Team, EBnet Implementation Team, etc.). All major discrepancies will be closed before this testing phase is considered complete and EBnet is considered ready to support EBnet user and end-to-end tests. Other issues will be reviewed for potential impact on the EBnet user and end-to-end tests.

EBnet Verification and Verification (V&V) activities will permit life-cycle coverage by a separate evaluator of EBnet requirements verification and system performance. EBnet requirements verification will address the ability of EBnet to satisfy the requirements outlined in the *Earth Science Data and Information System (ESDIS) Project Level 2 Requirements, Volume 6 EOSDIS Backbone Network (EBnet) Requirements* [1] by observing and reviewing results from testing performed by the EBnet project, EOSDIS sister projects, and EBnet users. No unique V&V testing is planned. Only independent, EBnet-specific modeling/simulation (e.g., verifying EBnet

supports EOS plus 3 years) and inspection efforts will be performed. Using output from the Requirements and Traceability Management (RTM™) database, candidate test cases from EBnet FAT, EOSDIS sister projects, and EBnet users will be identified. Coordination will be performed with the respective test elements to ensure the ability to observe testing and to obtain detailed test results. Evaluations from these test observations and results will be performed to determine the extent that EBnet has satisfied the corresponding requirement in the *Earth Science Data and Information System (ESDIS) Project Level 2 Requirements, Volume 6 EOSDIS Backbone Network (EBnet) Requirements* [1]. Discrepancies will be tracked in a database with resolution of discrepancies addressed by the designated party (e.g., EBnet Design Team, EBnet Implementation Team, etc.).

EBnet will also perform another role during the conduct of the EOSDIS sister projects and EBnet users tests. In many cases, EBnet will provide the connectivity between the various EOSDIS elements (e.g., DAACs, EDOS, EOC, etc.) to support testing efforts. EBnet will be responsible for addressing the EBnet M&O requirements associated with each test and for ensuring that EBnet is available. The EBnet project has opened dialog with the various test elements to identify test support requirements and is a member of the ESDIS System Integration and Test (SI&T) Working Group known as the Test Integration and Certification Oversight Committee (TICTOC) and the EOSDIS Integrated Product Team (IPT). Nascom is a member of these working groups and regularly attends meetings, thereby ensuring up-to-date information dissemination. During the execution of the various ESDIS and EBnet users tests, the EBnet Test Team will perform the necessary interfacing role as directed by the EBnet PM.

During the generation of the System/Acceptance Test Plan, EBnet project personnel will be reestablishing contact with test personnel of the various EOSDIS projects and EBnet users. The first purpose of this contact is to ensure they are fully cognizant of EBnet functionality and to finalize test support requirements. The second purpose is to become fully knowledgeable of ESDIS level tests in order to support testing activities. The final purpose is to receive the ground rules related to observing and receiving feedback on specific EOSDIS project and EBnet user tests designated to support EBnet Level 2 Requirements Verification.

3.5 Test Team Roles and Responsibilities

The Test Team is organized as shown in Figure 3-4 and described below.

The Test Director (TD) from Code 303 is responsible for managing the EBnet testing activities. The TD is collocated within the Nascom Division, and reports directly to the EBnet PM. During testing, the TD is responsible for the conduct of the EBnet testing activities. During testing, the TD will monitor the on-site testing through the use of on-site visits, the EBnet network management capabilities, and various electronic means.

A Test Lead (TL) will assist the TD in planning and coordinating the EBnet testing. The TL will plan, coordinate, and monitor the test activities working closely with the TD and the respective Designated Test Engineers (DTE) for FAT and SI&AT. The TL will also monitor the EBnet Problem Tracking Database System Problem Reports (SPR). He will also be responsible for managing the completion of the System/Acceptance Test Report that will include a summary of test

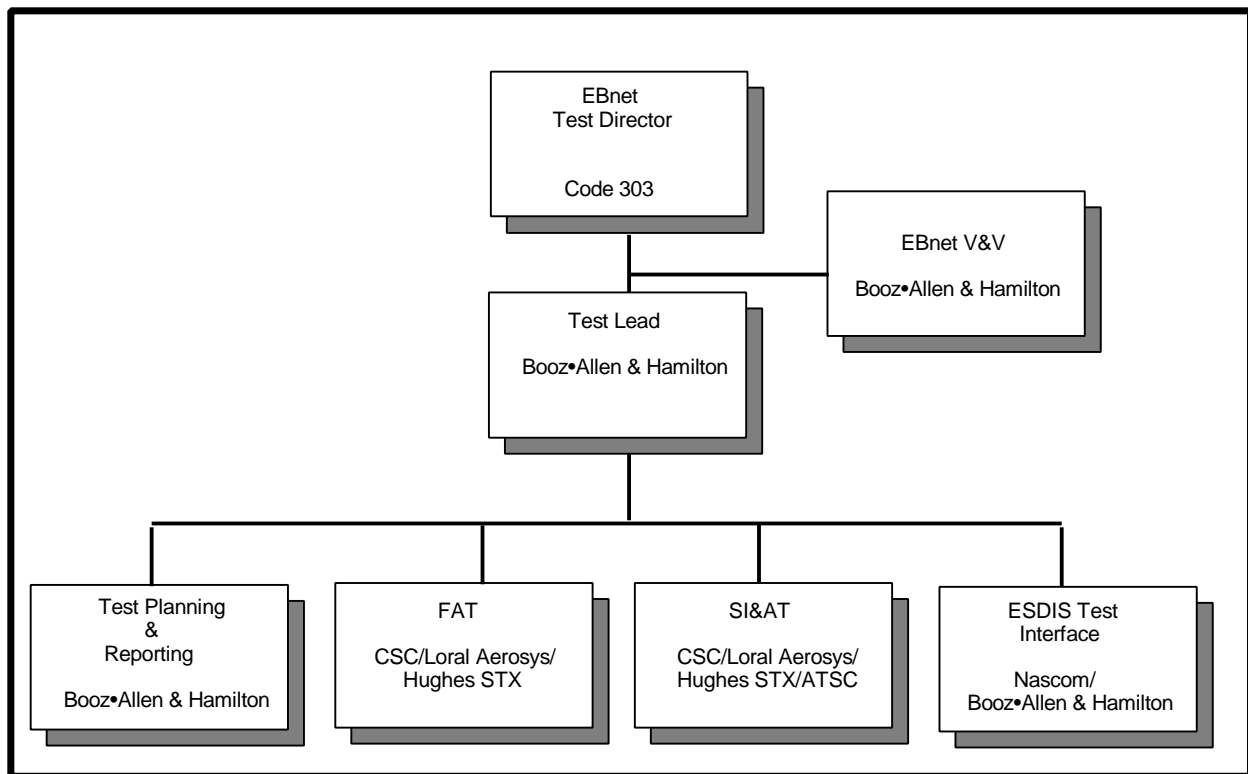


Figure 3-4. EBnet System/Acceptance Test Team Organization

results and discrepancies. The TL will also support the TD in performing required ESDIS interface efforts.

The EBnet V&V Engineer will be responsible for completing a separate requirements verification. The activities associated with this effort include requirement analysis and traceability, EOSDIS project and EBnet user test observation, and EBnet modeling and simulation. The EBnet V&V Engineer will also be responsible for presenting his requirements assessment to the EBnet PM.

The Booz•Allen support roles listed in Figure 3-4 associated with the EBnet V&V, TL, Test Planning and Reporting, and ESDIS Test Interface will be performed by the same Full Time Equivalent (FTE).

The DTE will be responsible for managing the on-site team in conducting the test procedures at that respective site. The Designated EBnet Test Engineer will be responsible for generating SPRs and forwarding test results. An CSC member of the EBnet Test Team will be assigned as the DTE for FAT and SI&AT. He will be supported by Loral, Hughes STX, and ATSC.

The remaining test personnel will perform the step-by-step test procedures under the guidance of the DTE. They will be responsible for completing the test records (see Appendix A) which will be forwarded to the DTE for further disposition.

Section 4. Test Plan

4.1 Test Objectives

The EBnet System/Acceptance Test Program has three primary objectives:

- To validate that the EBnet network meets the design specified in the *EOSDIS Backbone Network (EBnet) Design Package* [3]
- To verify that the EBnet network meets the functional, performance, and operational requirements of the *Earth Science Data and Information System (ESDIS) Project Level 2 Requirements, Volume 6 EOSDIS Backbone Network (EBnet) Requirements* [1]
- To verify that the EBnet network satisfactorily supports the ESDIS end-to-end user requirements in terms of function, performance, and operations.

4.2 FAT

FAT tests have been established for the transport and network management functions. Each area pertaining to these functions will be verified by completing specific test cases which will be included in the second submission of Appendix A.

4.2.1 Assumptions and Constraints

The following assumptions and constraints are relevant to the execution of FAT:

- Sufficient time and training will be available to make the CNMOS and Hughes STX personnel familiar with the EBnet environment.
- The EBnet Design Team has successfully completed Critical Design Review/AM-1 Review.
- The EBnet Modeling, Analysis, and Testbedding (EMAT) test equipment will be available to support testing.
- EBnet Design Team on-call support will be available to address any engineering-related issues.
- All Level 1 SPRs can be resolved during the FAT test period.
- Initial logistics support will be in place and maintenance spares will be available at the Greentec IV location.

4.2.2 Transport Function

Testing of the EBnet transport function will verify the following major areas:

- Functional
- User interface

- Common-carrier interface
- Performance.

Test cases will be defined to address specific transport functions. Successful completion of all test cases will verify that the transport equipment has been properly configured and that the equipment is fully operational.

EBnet transport equipment will be tested in a simple multinode network as shown in Figure 4-1. These tests will center on the capabilities of transport equipment to support protocols, specific user interfaces, and maximum user data rates. The test tools will include but are not limited to:

- Protocol and LAN analyzer/generator
- AdTech Channel Simulator
- SNMP query software.

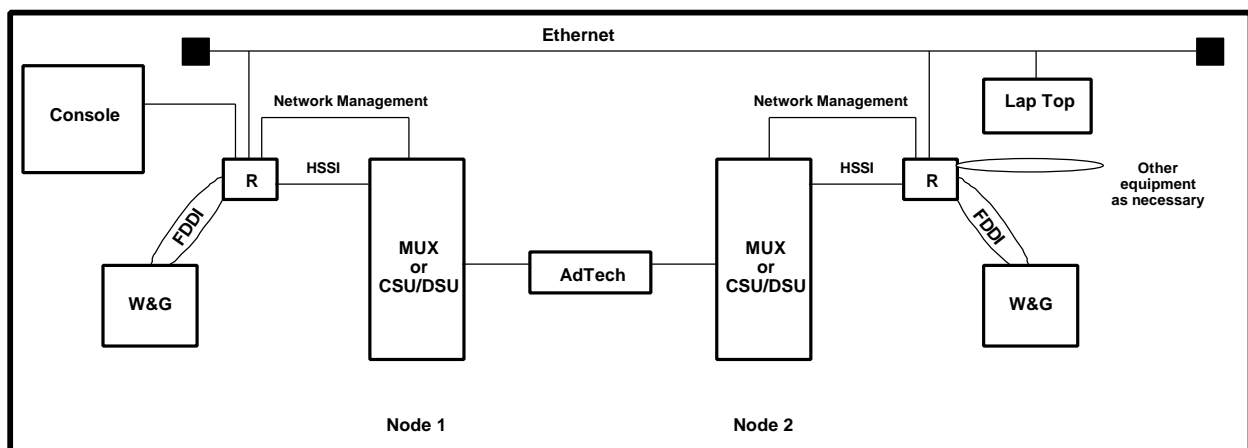


Figure 4-1. EBnet Factory Acceptance Test Environment

The specific industry standards in the *EOSDIS Backbone Network (EBnet) Interface Requirements Document* [2] will be used to verify EBnet compliance to specific selected protocols. The analyzer/generator will be used to verify user interfaces by permitting the assembly of user-specific message types, data transfer using the user-designated protocols, and collection of test results. Verification testing will be performed by sending test messages which emulate specific users and protocols.

Common-carrier interface requirements will be tested by performing test cases involving the simple network shown in Figure 4-1. These tests will verify EBnet's ability to perform with different transmission media and loopback and corrective actions. In performing this testing, the test tools will include:

- Test equipment with T1/T3 testing capabilities
- T1/T3 Multiplexers
- AdTech Channel Simulator

- Protocol analyzer.

EBnet compliance with performance requirements will be verified by using multinode test cases. Individual test cases and scenarios will verify EBnet ability to transfer network data at the required throughput. Test tools will include Sun workstations, protocol analyzers, and an AdTech Channel Simulator. Test results will be compared against the data flows contained in the *EBnet Traffic Database* [4]. The Sun workstations will input test packets into the input ports of the router. At the router output ports, the protocol analyzers will evaluate the processed packets. The destination workstation will receive the processed packets.

4.2.3 NOC Function

Testing of the network management functional requirements verifies that the M&O personnel can monitor and control the EBnet network from the NOC. Verification of the following functional capabilities will be performed through a combination of inspections and test scenarios:

- Monitoring
- Management Information Base (MIB) Data Collection & Processing
- Remote Configuration
- Fault Diagnostics and Isolation
- Trouble Ticketing
- Event/Trap Configuration & Handling
- Reporting/Display.

For this testing, a router will be the only external test tool planned.

4.2.4 Network Management Agent Function

Testing of the network management agent verifies that M&O personnel can configure, monitor, and control the network management agent within the transport equipment. All test cases will be performed using the multinode test configuration shown in Figure 4-1. For this testing, the SNMP query software is the only test tool planned. The SNMP query software will be used to simulate NOC commands. Verification of the following functional requirements will be performed through test scenarios:

- SNMP Managability (SNMP get and set)
- Trap Handling.

4.3 SI&AT

Site acceptance will be contingent upon completion of site installation and successful SI&AT. Transport and network management regression test cases from FAT will be identified to address FAT reverification. Successful completion of these regression test cases will signify that EBnet is ready to support both EOSDIS project and EBnet user testing.

4.3.1 Assumptions and Constraints

The following assumptions are relevant to the execution of the SI&AT:

- FAT has been successfully completed. All Level 1 SPRs can be resolved during the FAT test period.
- The EBnet nodes and network will be up and running.
- The EMAT test equipment will be available to support testing.
- EBnet Design Team on-call support will be available to address any engineering-related issues.
- Initial logistics support will be in place and maintenance spares will be available at each site.
- ESDIS and EBnet user testing may place constraints on the performance of SI&AT. Coordination will be performed early in the test planning to resolve any conflicts between ESDIS and EBnet test requirements.

4.3.2 Transport Regression Testing

Transport regression testing will be scheduled testing to reverify the FAT transport test results in the installed site configuration.

Regression testing of the EBnet transport function will verify the following major areas:

- Functional/Configuration
- User interface
- Common-carrier interface
- Performance.

EBnet transport equipment will be tested in the final configuration. The transport equipment will be verified for proper hardware and software configuration and to ensure functional capabilities are performing correctly. Available EOSDIS project and EBnet user interfaces will be tested by verifying connectivity and transfer of simple messages. Common-carrier interfaces will be tested ensuring proper connectivity with premise telephone service. Performance requirements will be verified by transferring network data at the required throughput for that node.

4.3.3 Network Management Regression Testing

Network regression testing will include scheduled testing to reverify both FAT NOC and network management agent test results in the installed site configuration.

Regression testing of the EBnet network management function will verify the following major areas:

- SNMP Managability (SNMP get and set)

- Trap Handling.

Regression testing will focus on the ability of the NOC to complete the various network management functions for the installed nodes.

4.4 Level 2 Requirements Verification

Level 2 Requirements Verification will be contingent upon successful certification of the *Earth Science Data and Information System (ESDIS) Project Level 2 Requirements, Volume 6 EOSDIS Backbone Network (EBnet) Requirements* [1]. Requirement verification will be completed through three major test methods: (1) technical analysis; (2) inspection; and (3) test. Technical analysis will verify requirements that address functionality that will not be present during the first two installations of EBnet. Inspection will be conducted on requirements that can be verified through visual evaluation of EBnet functionality. Tests will center on verifying requirements through observation of scheduled EOSDIS and EBnet users testing. EBnet does not plan to perform any independent testing. A detailed description of each verification approach is provided in Sections 4.4.2 to 4.4.4 below. Appendix B identifies the specific test cases to be observed/performed to support EBnet Level 2 Requirements Verification.

4.4.1 Assumptions and Constraints

The following assumptions are relevant to the execution of the EBnet Level 2 Requirements Verification:

- EBnet equipment will be installed
- The EBnet nodes and network will be up and running
- The EOSDIS sister projects and EBnet users will perform scheduled tests
- The EOSDIS sister projects and EBnet users will permit observation by the EBnet V&V Team
- EBnet Design Team on-call support will be available to address any engineering-related issues
- Modeling and simulation tools will be available to support EBnet V&V technical analysis.
- Sufficient documentation will be made available to complete technical analysis.

4.4.2 Technical Analysis

Specific EBnet requirements will require an independent technical analysis because the requirement cannot be verified by an actual test. These requirements will be verified using a controlled modeling/simulation scenario or through an analysis of technical documentation.

Modeling/simulation will center on performing controlled scenarios to verify the capability or function which will not be present during the first two installations of EBnet equipment. Results of the modeling/simulation scenario will be evaluated against expected results to determine

whether or not the requirement has been successfully verified. In many cases, the scenario will be performed several times to receive an accurate picture of results.

Review of technical documentation will be performed to determine the technical integrity and quality of the product. Each document will be evaluated against specific criteria to determine if the product meets the EBnet requirement.

4.4.3 Inspection

Several EBnet requirements will be verified through inspection. Inspection will focus on performing a visual evaluation of the EBnet equipment. Interest will be made of the specific characteristics of the equipment at the time of the evaluation. These characteristics will be evaluated against established criteria in making the determination of whether EBnet satisfies the specific EBnet Level 2 requirement.

4.4.4 Test

A major part of EBnet V&V will be conducted by observing the FAT, SI&AT, other EOSDIS sister projects, and EBnet user tests and evaluating corresponding test results. No independent testing will be performed. Test cases from the following EOSDIS sister projects and EBnet user tests appear to be the most likely candidates:

- ECS Release A Segment and System Integration and Test
- EDOS Configuration 1 System Testing
- TRMM Ground System Integration and Test
- Landsat Ground System Integration and Test
- EGS Version 1 Test
- Mission Simulation Number 2
- Flight Operations Segment (FOS) Integration and Test
- TSDIS System Integration and Test.

A matrix in Appendix B provides the specific test cases identified to support EBnet Level 2 Requirements Verification. Coordination will be performed with the respective project test personnel to observe the test and receive a copy of the raw test data. Administrative information (e.g., the specific location, date, and time of the test) will be obtained from the respective TDs. A detailed observation plan will be developed to ensure that required information will be obtained for proper evaluation of the specific EBnet requirement(s).

4.5 Test Support Environment

The test support environment has been tailored by the EBnet Test Team to meet the EBnet network requirements and the testing approach. The specific uses of these tools will be provided in test cases submitted during the second iteration of this document.

4.5.1 FAT

The test tool support environment of FAT will involve both hardware and software test tools to verify equipment interfaces, functional capabilities, and network configuration. Potential tools include but are not limited to:

- Protocol/LAN analyzer and generator
- SNMP query tool
- Test equipment with EIA-422, T1, and T3 interface
- AdTech Channel Simulator.

4.5.2 SI&AT

The SI&T test tools are limited to hardware and software to verify specific transport and network management requirements. To address these projected needs, a protocol/LAN analyzer and generator is envisioned.

4.5.3 Level 2 Requirements Verification

The Level 2 Requirements Verification test tools are limited to modeling and simulation software to verify several requirements that cannot be certified through inspection or testing.

4.6 Schedule Requirements

Figure 4-2 provides the System/Acceptance Test Project Evaluation Review Technique (PERT) Chart for the planned installations. A detailed test schedule showing the completion of each test will be formulated during the development of the test procedures.

4.7 Security Considerations

Entrance access and inside-building access security requirements at NASA sites will be the major security considerations during testing. Required authorizations will be in place before test start. Personnel will be briefed on any site-specific access security rules.



4.8 Problem Reporting and Discrepancy Handling

The objective of problem reporting and discrepancy handling is to provide timely, complete, and accurate data on EBnet problems. These reports will provide the up-to-date testing information and permit the EBnet Design Team to quickly address any problems which may arise. The EBnet Test Team will use a combination of management reporting and RTM database for problem reporting and handling discrepancies. The RTM database, maintained by Booz•Allen & Hamilton, an CNMOS contractor, will contain a record of all SPRs identified during the EBnet System/Acceptance Testing effort. SPRs generated during EOSDIS project and EBnet User testing will also be maintained in this database.

4.8.1 Problem Reporting

Problem reporting will be performed using management reports and SPRs.

The management reports will consist of daily reports, weekly and progress reports, and the EBnet Test Report.

The TL will generate daily reports using a computerized form and will electronically forward the report to the TD. The daily report will describe the test progress and identifies any problems encountered during testing. The TD will review each report, analyzes testing progress, EBnet testing issues, and administrative problems. Any problems which could impact the scheduled completion of any EBnet Testing will also be forwarded to the EBnet PM if the problem warrants immediate attention.

The weekly report will be generated by the TL. The weekly report will provide a summary of test cases completed during the previous week. The weekly reports also will provide a listing of the problems (SPRs and administrative test problems) uncovered during the reporting period.

An EBnet Test Report will be generated after each SI&AT and Level 2 Requirements Verification effort. The report will provide a detailed summation of all test results and SPRs. Information provided on each SPR will include the initial report and supporting data, current status, and resolution.

4.8.2 Discrepancy-Handling Procedures

Upon identifying an EBnet discrepancy, the EBnet Test Team will follow a process which includes identification, analysis, and documentation.

The test member who discovered the discrepancy will complete a computerized Event Report form located on a Personal Computer (PC)-based system.

The DTE will analyze the Event Report and complete a computerized SPR form (shown in Figure 5-13 of the Nascom Configuration Management Plan). The DTE will then electronically forward the SPR to the TL through a modem connected to the PC-based system. The test log will also be annotated with the SPR number at the point the discrepancy occurred.

The TL will review the SPR for completeness and electronically forward the SPR through the use of a modem to the TD for approval and submission into the EBnet RTM database.

On a weekly basis, the TL will follow up with the TD regarding the SPR status. Once the solution is completed and verified by the EBnet Design Team, the change will be validated by the EBnet Test Team using the same test procedure with which the discrepancy was identified. Any other retesting will be coordinated with the TD, EBnet PM, and the respective site. Upon successful resolution validation, the EBnet Test Team will recommend closure of the discrepancy. If the change does not pass the EBnet Test Team retest, the EBnet Design Team will be notified and test results will be provided to assist in further analysis.

4.9 Access to Test Results

Test results will consist of test logs, on-line printouts, and other test materials generated during the test. Procedures have been generated to ensure that all test results will be controlled.

4.9.1 On Site

The on-site DTE will be responsible for controlling the test results generated during conduct of the tests at the specific site. The DTE will be responsible for ensuring that the test results for the completed test cases are compiled and controlled until the test is completed. At the completion of the testing, the DTE will be responsible for forwarding all test results of the complete test set to the TL for further analysis.

4.9.2 Off Site

After receiving the test set data, the TL will be responsible for logging in and placing the original results in a secure area. As currently planned, the original test results will remain in the secured file cabinet at the Booz•Allen & Hamilton Seabrook facility. Copies of the test results will be generated for Project use. Copies can to be requested by contacting the TD. The original test results will be provided to the TD for final disposition.

Abbreviations and Acronyms

ACRIM	Activity Cavity Radiometer Irradiance Monitor
ADC	Affiliated Data Centers
ADEOS	Advanced Earth Observing Satellite
ADS	Archive Data Set
ALT	Altimetry
ASF	Alaska SAR Facility
ASTER	Advanced Spaceborne Thermal Emission Radiometer
ATSC	AlliedSignal Technical Services Corporation
BER	Bit Error Rate
CCB	Configuration Control Board
CHEM	Chemistry
CM	Configuration Management
CNMOS	Consolidated Network and Mission Operations Support
COTS	Commercial Off-The-Shelf
CSC	Computer Sciences Corporation
DAAC	Distributed Active Archive Center
DCN	Document Change Notice
DoD	Department of Defense
DS	Digital Signal
DSN	Deep Space Network
DTE	Designated Test Engineer
EBnet	EOSDIS Backbone Network
ECS	EOSDIS Core System
EDC	EROS Data Center
EDOS	EOS Data and Operations System
EGS	EOS Ground System
EMAT	EBnet Modeling, Analysis and Testbedding

EOC	EOS Operations Center
EOS	Earth Observing System
EOSDIS	EOS Data and Information System
EROS	Earth Resources Observation System
ESDIS	Earth Science Data and Information System
ETS	EOSDIS Test System
FAT	Factory Acceptance Test
FDF	Flight Dynamics Facility
FOS	Flight Operations Segment
FSTB	Flight Software Testbed
FTE	Full Time Equivalence
GN	Ground Network
GSFC	Goddard Space Flight Center
IP	Internet Protocol
IPT	Integrated Product Team
JPL	Jet Propulsion Laboratory
LAN	Local Area Network
LaRC	Langley Research Center
LPF	Launch Processing Facility
LPS	Landsat Processing System
M&O	Maintenance and Operations
MIB	Management Information Base
MO&DSD	Mission Operations and Data Systems Directorate
MTTRS	Mean Time to Restore Service
NASA	National Aeronautics and Space Administration
Nascom	NASA Communications
NCC	Network Control Center
NOAA	National Oceanic and Atmospheric Administration
NOC	Network Operations Center

NSI	NASA Science Internet
NSIDC	National Snow and Ice Data Center
PDS	Production Data Set
PERT	Project Evaluation Review Technique
PM	Project Manager
QDS	Quick-look Data set
RTM	Requirements and Traceability Management
SAGE	Stratospheric Aerosol and Gas Experiment
SAR	Synthetic Aperture Radar
SAS	Spacecraft Analysis System
SCS	Spacecraft Checkout System
SDS	Software Development System
SI&T	System Integration and Test
SI&AT	System Integration and Acceptance Test
SIP	System Implementation Plan
SMC	System Management Center
SNMP	Simple Network Management Protocol
SOLSTICE	Solar Stellar Irradiance Comparison Experiment
SPR	System Problem Report
SSIM	Spacecraft Simulator
TD	Test Director
TICTOC	Test Integration and Certification Oversight Committee
TL	Test Lead
™	Trademark
TRMM	Tropical Rainfall Measuring Mission
TSDIS	TRMM Science Data and Information System
V&V	Verification and Validation
VAFB	Vandenberg Air Force Base
VFPA	Valley Forge, Pennsylvania

WAN	Wide Area Network
WOTS	Wallops Orbital Tracking Station
WSC	White Sands Complex

Glossary

element	hardware or software that can be identified as an individual item, assembly, combination of subassemblies, or software modules that have specific function.
user/users	Any organizational entity or group of entities that uses EBnet.
real-time data	includes spacecraft commands, housekeeping data, housekeeping playback data, tracking data, and science telemetry.
requirements assessment <i>System</i>	The recommendation provided to the EBnet PM regarding whether or not EBnet meets the <i>Earth Science Data and Information (ESDIS) Project Level 2 Requirements, Volume 6 EOSDIS Backbone Network (EBnet) Requirements</i> [1].
requirements verification	A formal process of determining whether a system meets its system accepted criteria.
science data	science data includes Quick-look Data Sets (QDSs), Production Data Sets (PDSs), and Archive Data Sets (ADSs) transferred from the EDOS to the DAACs and between DAACs.
test case	Documentation specifying inputs, predicted results, and a set of execution conditions for a test item.

Appendix A. FAT Procedure Template

The FAT procedures will be contained in this section. This submission provides the test procedure template to be used to develop the final procedures.

Final test procedures will be available 20 working days before FAT start.

To ensure consistency in Factory Acceptance Test procedure contents, this template provides the specific set of fields for the Factory Acceptance Test Procedure. Paragraphs A.1 through A.9 represent the entries to be completed during the generation of the Test Case Description. Paragraphs A.10 through A.14 represent the entries to be completed during the generation of the Factory Acceptance Test Detailed Test Steps. Paragraphs A.15 through A.23 represent the Factory Acceptance Test Record entries to be completed during the actual execution of the specific test case.

Test Case Description Template Fields:

A.1 Test Case Number: <Test Case No. 1>

Test Case Number field is the Configuration Management (CM) Number assigned to this Factory Acceptance Test Case.

A.2 Factory Acceptance Test Case Objective

The Factory Acceptance Test Case Objective field describes the objective of the test.

A.3 Factory Acceptance Test Case Requirements Validated

The Factory Acceptance Test Case Requirements Validated field describes the design requirement to be validated.

A.4 Sequence of Factory Acceptance Test Cases

The Sequence of Factory Acceptance Test Cases field illustrates any Factory Acceptance Test/Scenario sequencing that may be necessary. This logical order is derived by evaluation of Entry/Exit Criteria.

A.5 Assumptions and Constraints

The Assumptions and Constraints field provides any assumptions and constraints that are to be considered in completing this Factory Acceptance Test Case. These assumptions should be written in specific detail to ensure the reader has complete understanding of the potential impacts.

A.6 Entry Criteria

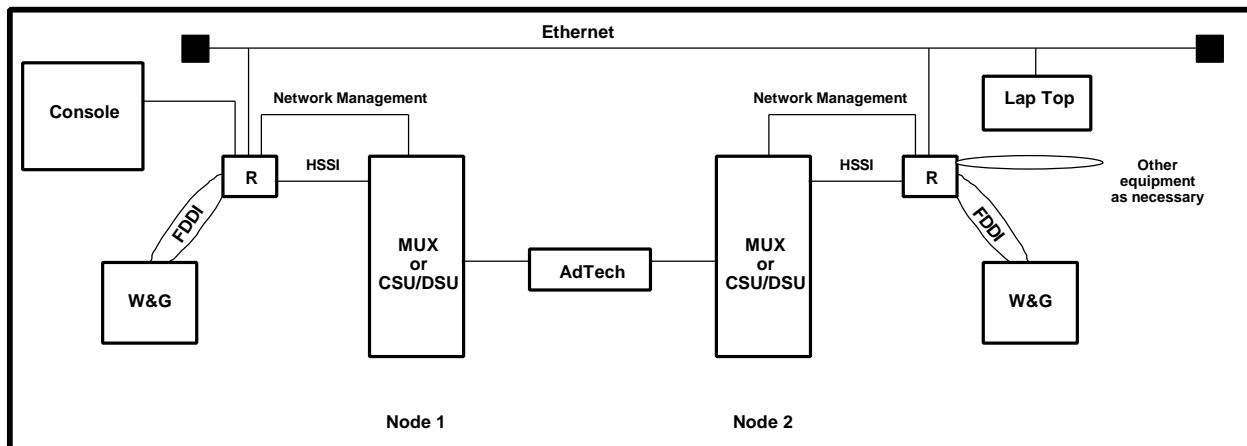
The Entry Criteria field describes the specific activities and items that must be available prior to execution of this Factory Acceptance Test Case. Activities include testing activities, training, test equipment, and documentation.

A.7 Exit Criteria

The Exit Criteria field describes the specific verification results expected at the successful completion of the Factory Acceptance Test Case. These results must be met before the Factory Acceptance Test Case can be considered successfully complete.

A.8 Test Configuration

The Test Configuration field describes the specific test configuration to be used in completing the Factory Acceptance Test Case. EBnet and test equipment should be clearly delineated. An example is provided below in Figure 1.



FAT Test Configuration (Sample Only)

Figure 1

A.9 EBnet Configuration Item(s) Under Test

The Test Configuration Item(s) Under Test field describes the specific EBnet equipment being tested. Many of the test cases will focus on the functionality of a specific piece of EBnet equipment (e.g., router, multiplexer, network management system, etc.).

B. Factory Test Procedure Template Fields:

A.10 Test Data

The Test Data field describes the information (test stimulus) required to perform the test. Information is to be placed in a matrix format with the following column headings: (1) Description/Characteristics; and (2) File Name(s)/Location. A sample matrix is shown in Figure 2.

Description/Characteristics	File Name(s)/Location

Figure 2

A.11 Test Setup

The Test Setup field describes the specific steps, in logical sequence, to establish the test setup environment required to initiate the Factory Acceptance Test Procedure. Information is to be placed in a matrix format with the following column headings: (1) Step; (2) Location/Station; (3) Action; (4) Expected Results; and (5) Comments. A sample matrix is shown in Figure 3.

Step	Location/Station	Action	Expected Results	Comments

Figure 3

A.12 Test Execution

The Test Execution field describes the specific steps, in logical sequence, to complete the required test execution leading to the final expected results. Information is to be placed in a matrix format with the following column headings: (1) Step; (2) Location/Station; (3) Action; (4) Expected Results; and (5) Comments. A sample matrix is shown in Figure 4.

Step	Location/Station	Action	Expected Results	Comments

Figure 4

A.13 Test Termination

The Test Termination field describes the specific steps, in logical sequence, to place the test environment back to the original environment. Information is to be placed in a matrix format with the following column headings: (1) Step; (2) Location/ Station; (3) Expected Results; and (4) Comments. A sample matrix is shown in Figure 5.

Step	Location/Station	Action	Expected Results	Comments

Figure 5

A.14 Post-Test Analysis

The Post-Test Analysis field describes any analysis required of test data received during testing. Sufficient information to the analysis type, support tools, and required expertise should be provided.

Test Record Template Fields:

A.15 Tester

The Tester field provides the name, title, organization, phone number, and electronic mail address of the lead FAT tester.

A.16 Test Start Date/Time

The Test Start Date/Time field records the specific date (month-date-year) and time (using local standard time) of test initiation.

A.17 Test Complete Date/Time

The Test Complete Date/Time field records the specific date (month-date-year) and time (using local standard time) of the conclusion of the test.

A.18 Test Location

The Test Location field provides the specific location of the test including room number and building address.

A.19 Specific Phase <Phase No.>

The Phase field provides the specific EBnet Phase that the Factory Acceptance Test was conducted.

A.20 Test Manager

The Test Manager field provides the name, title, organization, phone number, and electronic mail address of the responsible Test Manager.

A.21 Equipment Configuration

The Equipment Configuration field provides the part and serial numbers of the equipment under test to the board level. This field will be filled in only during System Integration and Acceptance Test.

A.22 Test Monitor

The Test Monitor field provides the names, titles, organizations, phone numbers, and electronic mail address of all test witnesses.

A.23 Comments

The Comments field will include any notes considered necessary in evaluating the conduct and/or results of the Factory Acceptance Test Procedures.

Appendix B. Requirements Verification Matrix

The detailed approach for verifying the *Earth Science Data and Information System (ESDIS) Project Level 2 Requirements, Volume 6 EOSDIS Backbone Network (EBnet) Requirements* [1] is provided in this section.

The matrix provides the requirement identification, requirements text, verification matrix, and proposed test approach. In many cases tests from other EOSDIS projects and EBnet users (e.g., Landsat, TRMM) have been identified.

Requirement ID	Text	Verification Method	Plan Reference
EB1000	EBnet shall provide appropriate training and training aids to operators and technicians for each EBnet component.	Inspection	Through Inspection of Training Package and Training Instruction during EBnet Phase A Install
EB1010	EBnet shall prototype all functions and standards that are user-sensitive, high risk, or involve untried approaches and technologies.	Inspection	Evaluation of EMAT Activities and Reports
EB1020	In support of system safety requirements, EBnet shall ensure all safety considerations are satisfied in conjunction with EDOS and ECS.	Inspection	ECS Evaluation Made During ECS Release A Segment and System I&T Plan, BC010.005, (page 4-246) Evaluation Made During EDOS System Test, Configuration 1
EB2000	EBnet shall be modular in design.	Inspection	Evaluation Made During ECS Release A Segment and System I&T Plan, BC010.005, (page 4-246)
EB2010	EBnet internal design changes shall be as transparent to the user to the maximum extent possible. Any changes that will not be transparent must be coordinated with the user community before implementation.	Inspection	Evaluation Made During ECS Release A Segment and System I&T Plan, BC010.005, (page 4-246) Evaluate EBnet Change Process Approach by EBnet V&V
EB2020	EBnet shall maximize opportunities for commonality within the system.	Inspection	Evaluation Made by EBnet V&V During ECS

			Release A Segment and System I&T Plan, BC010.005, (page 4-246)
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Requirement ID	Text	Verification Method	Test Plan Reference
EB2030	EBnet shall include development, testing, operations, and maintenance for the life of the supported missions in Table 8-1 of the Execution Phase Project Plan for EOS [1], including Advanced Earth Observing Satellite (ADEOS) II, Tropical Rainfall Measuring Mission (TRMM), LANDSAT-7/ETM, LANDSAT-7/COLOR, EOS-AM, EOS-PM, LASER Altimetry (ALT), Chemistry (CHEM), Activity Cavity Radiometer Irradiance Monitor (ACRIM), RADAR ALT, Stratospheric Aerosol and Gas Experiment (SAGE) III, and Solar Stellar Irradiance Comparison Experiment (SOLSTICE).	Test, Modeling	<p>Landsat Ground System I&T Plan, I&T #9, (page 6-9-1)</p> <p>TRMM Ground System I&T Plan, I&T #7, (page 6-7-1)</p> <p>ECS Release A Segment and System I&T Plan, BC010.004, (page 4-244)</p> <p>EBnet Modeling for Missions Scheduled After Landsat by EBnet V&V</p>
EB2040	For any custom developed applications, EBnet shall conform to the quality assurance requirements in accordance with NASA Handbook 5300.4 (1B), Quality Program Provisions for Aeronautical and Space System Contractors, [3] tailored to the EBnet project and mission requirements. There shall be no unique quality requirements levied for Commercial Off-The-Shelf (COTS) hardware and software over and above those used by the vendor. COTS hardware quality assessments shall be performed through product sampling prior to procurement.	Inspection	Evaluation of EMAT Reports and QA Vendor Data by Code 303 and EBnet V&V
EB2050	EBnet shall provide a sustaining engineering capability.	Inspection	Evaluation of Capabilities Within EMAT Lab by EBnet V&V
EB2060	EBnet shall support operations 24 hours per day, 7 days per week on a continuous basis.	Test	ECS Release A Segment and System I&T Plan, BC010.005, (page 4-246)
EB2070	EBnet shall be designed to accommodate growth in data rates and volumes for communications and networks in	Modeling	EBnet Modeling by EBnet V&V

	accordance with traffic requirements identified in Table 4 of the ESDIS Project Level 2 Requirements Volume 0, Overall ESDIS Project Requirements and Communications Requirements for the ECS Project. [2 and 4]		
EB2080	EBnet shall be able to add and remove common carrier interfaces and system elements without disruption of network service.	Test	EBnet Factory Acceptance Test

Requirement ID	Text	Verification Method	Test Plan Reference
EB2090	EBnet distributed elements shall operate as a single integrated and cohesive information system.	Inspection	ECS Release A Segment and System I&T Plan, BC010.005, (page 4-246)
EB2100	EBnet transport services shall be transparent to users. Users shall not require any special knowledge of the location and function of the EBnet distributed element or the transport services being used.	Test	ECS Release A Segment and System I&T Plan, BC010.005, (page 4-246)
EB2110	EBnet shall maintain all data from receipt to delivery to within the Bit Error Rate (BER) performance boundaries specified in Table 3-1.	Test	ECS Release A Segment and System I&T Plan, BC010.005, (page 4-246)
EB2120	EBnet shall transport data within the maximum one-way delay of 0.5 seconds.	Test	ECS Release A Segment and System I&T Plan, BC010.005, (page 4-246)
EB2130	EBnet shall include development, testing, operations, and maintenance from the completion of the life of EOS and LANDSAT plus 3 years.	Test, Modeling	Landsat Ground System I&T Plan, I&T #9, (page 6-9-1) EBnet Modeling by EBnet V&V
EB2140	EBnet shall support independent test activities of the end-to-end EOSDIS throughout its life.	Inspection	Certification for EGS Version 1
EB2150	EBnet shall provide system verification and evaluation test definitions for transmission quality testing of its common carrier networks used.	Inspection	EBnet System Integration and Acceptance Test
EB2160	The communications and networks utilized or provided by the EBnet shall be capable of being tested and perform simulations during all phases of EOSDIS development and mission operations without interfering with the normal communications and networking traffic.	Inspection	ECS Release A Segment and System I&T Plan, BC010.005, (page 4-246)
EB2170	EBnet shall provide the capability to monitor system processes during testing.	Test	ECS Release A Segment and System I&T Plan, BC010.005, (page 4-246)

EB2180	EBnet shall support the revalidation of performance capabilities whenever an element(s) upgrade/enhancement is made to EBnet which may cause a change in performance.	Test	EBnet Factory Acceptance Test
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Requirement ID	Text	Verification Method	Test Plan Reference
EB2190	EBnet shall provide tools and metrics to support testing, system performance monitoring, fault isolation, verification and validation of the end-to-end ground system.	Test	ECS Release A Segment and System I&T Plan, BC010.005, (page 4-246)
EB2200	EBnet shall support EOS prelaunch activities (e.g., operational readiness tests and simulations).	Inspection	Mission Simulation 2
EB2210	EBnet shall support all of the EOS spacecraft mission phases and mission modes.	Test, Modeling	ECS Release A Segment and System I&T Plan, BC010.005, (page 4-246) EBnet Modeling by EBnet V&V
EB2220	EBnet shall follow the intent of the applicable reliability program tasks delineated in NHB5300.4(1A-1), Reliability Provisions for Aeronautical and Space System Contractors, [5] tailored to the EBnet project and mission requirements. Reliability prediction data shall be obtained from the vendors.	Inspection	Inspection of prediction data from vendor; completed by Code 303 and EBnet V&V
EB2230	EBnet shall be maintainable.	Test, Inspection	ECS Release A Segment and System I&T Plan, BC010.005, (page 4-246)
EB2240	EBnet shall have an operational availability of 0.9998 as a minimum for forward and return real-time data communication.	Test, Modeling	ECS Release A Segment and System I&T Plan, BC010.005, (page 4-246) EBnet Modeling by EBnet V&V
EB2250	EBnet shall have a Mean Time To Restore Service (MTTRS) of 1 minute or less for forward and return real-time data communication.	Test, Modeling	ECS Release A Segment and System I&T Plan, BC010.005, (page 4-246) EBnet Modeling by EBnet V&V

Requirement ID	Text	Verification Method	Test Plan Reference
EB2260	EBnet shall have an operational availability of 0.98 as a minimum for science data transfer communication.	Test, Modeling	ECS Release A Segment and System I&T Plan, BC010.005, (page 4-246) EBnet Modeling by EBnet V&V
EB2270	EBnet shall have an MTTRS of 4 hours or less for science data transfer communication.	Modeling	ECS Release A Segment and System I&T Plan, BC010.005, (page 4-246) EBnet Modeling by EBnet V&V
EB2275	EBnet interface equipment for the interface between the Landsat Processing System (LPS) and the EOSDIS Core System (ECS) shall have an operational availability of 0.999 at the minimum and an MDT of two (2) hours or less.	Test	Landsat Ground System I&T Plan, I&T #4, (page 6-4-1) EBnet Modeling by EBnet V&V EBnet Modeling
EB2276	EBnet shall provide a backup to the interface between the Landsat Processing System (LPS) and the EOSDIS Core System (ECS) with a switch over time of 15 minutes or less from the primary interface to a backup capability.	Test	Landsat Ground System I&T Plan, I&T #4, (page 6-4-1)
EB2280	EBnet shall have an operational availability of 0.96 as a minimum for network management.	Modeling, Test	ECS Release A Segment and System I&T Plan, BC010.005, (page 4-246) EBnet Modeling by EBnet V&V
EB2290	EBnet shall have an MTTRS of 4 hours or less for network management.	Analysis, Modeling	ECS Release A Segment and System I&T Plan, BC010.005, (page 4-246)

			EBnet Modeling by EBnet V&V
EB2300	EBnet shall provide EBnet operators with access to local information management services at the nodes.	Test	EBnet System Integration and Acceptance Test

Requirement ID	Text	Verification Method	Test Plan Reference
EB2310	EBnet operator interface shall be tailored to functions which are authorized for the operator.	Test	EBnet System Integration and Acceptance Test
EB2320	EBnet shall provide access monitoring to compile and report security violations and attempted security violations.	Test	EBnet System Integration and Acceptance Test
EB2330	EBnet network management systems shall meet the criteria of Level of Security Sensitivity (C2)controlled access protection defined in Department of Defense (DOD) Trusted Computer System Evaluation Criteria as applicable. [6]	Analysis	Evaluation made during EBnet Factory Acceptance Test
EB2340	EBnet shall protect all data as Sensitivity Level 3 as specified in the NASA Automated Information Security Handbook except for Section 403d(2), Information and Application Labels. [7]	Test	EBnet System Integration and Acceptance Test
EB2350	EBnet shall support users that comply with NASA Communications Access Protection Policy and Guidelines. [8]	Inspection	Inspection of Nascom Security Officer Report By EBnet V&V
EB2360	The EBnet shall support end-to-end system fault isolation, including the capability to identify a failing node, element, and/or service, to the level necessary to correct the fault.	Test	ECS Release A Segment and System I&T Plan, BC010.004, (page 4-244)
EB2370	The EBnet shall maintain knowledge of current operational status of all EBnet elements.	Test	ECS Release A Segment and System I&T Plan, BC010.004, (page 4-244)
EB3000	EBnet shall transport operational data in accordance with NMI 2520.1D. [9]	Inspection	ECS Release A Segment and System I&T Plan, BC010.005, (page 4-246)
EB3010	EBnet/Nascom shall provide voice communications in support of mission operations, including all prelaunch activities.	Test	Mission Simulation #2

Requirement ID	Text	Verification Method	Test Plan Reference
EB3020	EBnet shall provide the capability to transport EOS operational data among EDOS facilities, ECS operational facilities, and the operational EOS users of EDOS data products including the EOS International Partners in a data-driven mode.	Test	EDOS System Test, Configuration 1 TRMM Ground System I&T Plan, I&T #7, (page 6-7-1) ECS Release A Segment and System I&T Plan, BC010.005, (page 4-246) ECS Release A Segment and System I&T Plan, BC010.004, (page 4-244)
EB3030	EBnet/Nascom shall provide the capability to support contingency-mode operations with the Deep Space Network (DSN) and Ground Network (GN) including the Wallops Orbital Tracking Station (WOTS).	Test	EDOS System Test, Configuration 1
EB3040	EBnet shall provide connectivity and data transport between the ground EOSDIS elements based on EOS traffic flows contained in the EBnet Traffic Database [10].	Test, Modeling	ECS Release A Segment and System I&T Plan, BC010.005, (page 4-246) EBnet Modeling by EBnet V&V
EB3050	The EBnet Traffic Database shall include traffic flows in and out of ECS (as addressed in the Communications Requirements for the ECS Project).	Test	ECS Release A Segment and System I&T Plan, BC010.004, (page 4-244)
EB3060	The EBnet Traffic Database shall include traffic flows for real-time telemetry, command, and control as addressed in Table 4 of the ESDIS Project Level 2 Requirements Volume 0, Overall ESDIS Project Requirements.	Test, Modeling	ECS Release A Segment and System I&T Plan, BC010.004, (page 4-244)

			EBnet Modeling by EBnet V&V
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Requirement ID	Text	Verification Method	Test Plan Reference
EB3070	EBnet shall have a contribution to the overall real-time operations(command up to acknowledge back) loop delay of no more than 0.75 seconds (TBR No. 3).	Test	EDOS System Test, Configuration 1 ECS Release A Segment and System I&T Plan, BC010.005, (page 4-246)
EB3080	EBnet shall transfer science data at a minimum of 45 Mb/sec from the ground station to the EDOS element at GSFC.	Test	EDOS System Test, Configuration 1
EB3090	The communications and networks utilized or provided by the EBnet shall make maximum practicable use of standards for data transportation defined by the International Standards Organization's "open system interconnect."	Inspection	ECS Release A Segment and System I&T Plan, BC010.005, (page 4-246)
EB3100	EBnet shall provide the capability to distribute data by electronic transmission.	Test	ECS Release A Segment and System I&T Plan, BC010.005, (page 4-246)
EB3110	EBnet shall provide the capability to manage EBnet system operation functions.	Test	ECS Release A Segment and System I&T Plan, BC010.004, (page 4-244)
EB3120	EBnet shall provide the capability to manage EBnet security functions.	Test	ECS Release A Segment and System I&T Plan, BC010.004, (page 4-244)
EB3130	EBnet shall provide end-to-end performance monitoring and control.	Test	ECS Release A Segment and System I&T Plan, BC010.005, (page 4-246)
EB3140	EBnet shall establish and maintain accounting information on communications and networks used or provided by the EBnet.	Test	ECS Release A Segment and System I&T Plan, BC010.004, (page 4-244)
EB3150	EBnet shall establish and maintain configuration	Test	ECS Release A

	information on communications and networks used or provided by the EBnet.		Segment and System I&T Plan, BC010.005, (page 4-246)
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Requirement ID	Text	Verification Method	Test Plan Reference
EB3160	EBnet shall provide the capability to manage EBnet fault isolation functions.	Test	ECS Release A Segment and System I&T Plan, BC010.005, (page 4-246)
EB3170	EBnet shall have the capability to duplicate network management functionality from the sustaining engineering capability within 24 hours of the catastrophic loss of the network management system.	Analysis	Formal Written Analysis Based on Evaluation of Sustaining Components and Emergency Operations Planning Document
EB3180	EBnet shall have a management interface to ECS to exchange network management information.	Test	FOS I&T Plan Test Case CMD1050A, (page 4-21)
EB4000	EBnet shall interface with the ECS(DAACs, [EOS Operations Center] EOC, System Management Center(SMC), and Affiliated Data Centers [ADCs]).	Test	<p>ECS Release A Segment and System I&T Plan, BC010.005, (page 4-246)</p> <p>FOS I&T Plan Test Case CMD1050A, (page 4-21)</p> <p>ECS Release A Segment and System I&T Plan, BC010.004 (DAAC/EOC), (page 4-244)</p> <p>ECS Release A Segment and System I&T Plan, BC011.009 (SMC), (page 4-288)</p>
EB4010	EBnet/NASA Communications(Nascom) shall interface with the Flight Dynamics Facility (FDF).	Test	TRMM Ground System I&T Plan, I&T #6,

			(page 6-6-1)
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Requirement ID	Text	Verification Method	Test Plan Reference
EB4020	EBnet/Nascom shall interface with the Network Control Center (NCC).	Test	TRMM Ground System I&T Plan, I&T #6, (page 6-6-1)
EB4030	EBnet/Nascom shall provide the interface with the DSN, GN, and with the WOTS for contingency mode operations.	Test	EDOS System Test, Configuration 1
EB4040	EBnet/Nascom shall interface with spacecraft integration and test facilities to support prelaunch activities, including spacecraft integration.	Test	EDOS System Test, Configuration 1
EB4050	EBnet shall interface with the launch processing site to support prelaunch activities.	Test	Mission Simulation #2
EB4060	EBnet shall interface with the National Oceanic and Atmospheric Administration (NOAA) Facility in Suitland, Maryland.	Test	ECS Release A Segment and System I&T Plan, Volume 2, BS018.002, (page 4-234)
EB4070	EBnet shall interface with International Partners.	Test	TSDIS System I&T Plan Scenario 7, (page 4-17)
EB4080	EBnet shall interface with EDOS.	Test	EDOS System Test, Configuration 1
EB4090	EBnet shall interface with the EOSDIS Test System (ETS).	Test	ETS Test, Test Configurations 1-5
EB4100	EBnet shall interface with the TRMM Science Data and Information System (TSDIS).	Test	TSDIS System I&T Plan Scenario C8, (pages 4-7 to 4-8)
EB4110	EBnet shall interface equipment between the LANDSAT Processing System (LPS) and the ECS, and provide switchable backup.	Test	Landsat Ground System I&T Plan, I&T #4, (page 6-4-1)
EB4120	EBnet shall have the capability to interface with common carrier Digital Signal (DS) 1 services.	Test	EBnet Factory Acceptance Test
EB4130	EBnet shall have the capability to interface with common carrier DS3 services.	Test	EBnet Factory Acceptance Test
EB4140	EBnet shall have the capability to be expanded to	Analysis	Based on Formal

	support an interface with common carrier Optical Carrier rate of 155.520 Megabits per second (OC3) services.		Evaluation of Vendor Hardware to Support OC3; vendor testing and EMAT results
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